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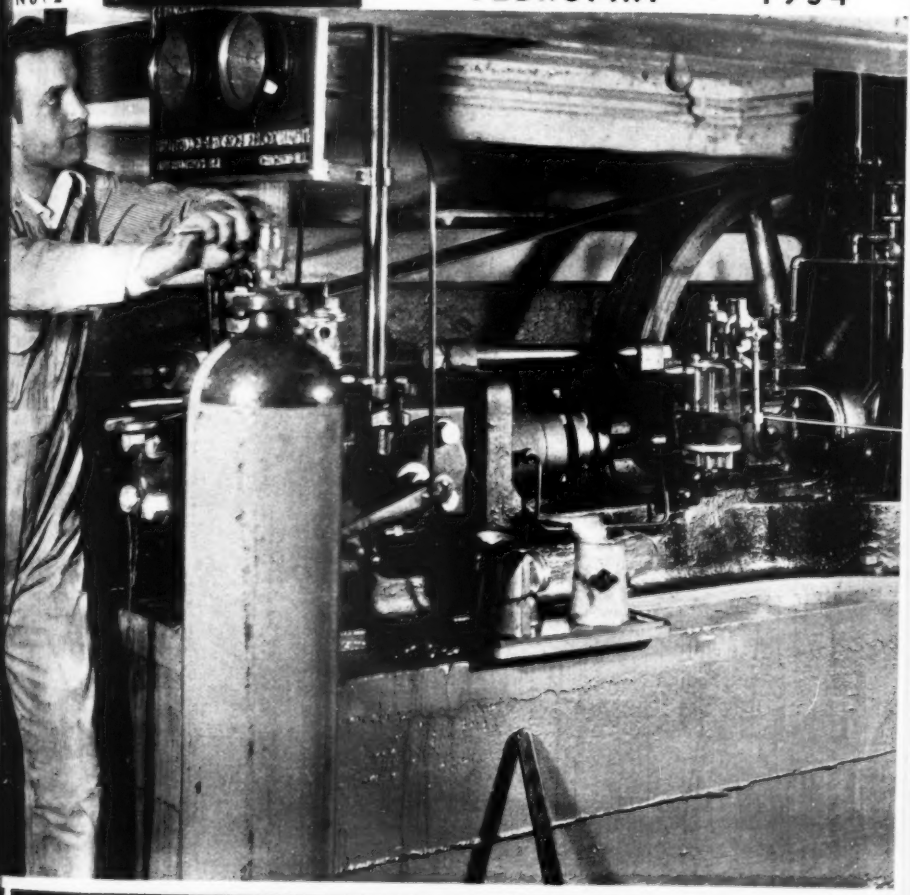

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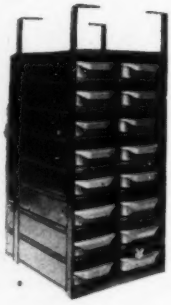

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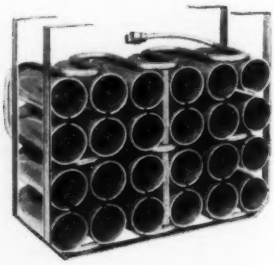

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Devoted to the Servicing of
REFRIGERATION UNITS *and* OIL BURNERS

VOL. 2 FEBRUARY, 1934 NO. 2

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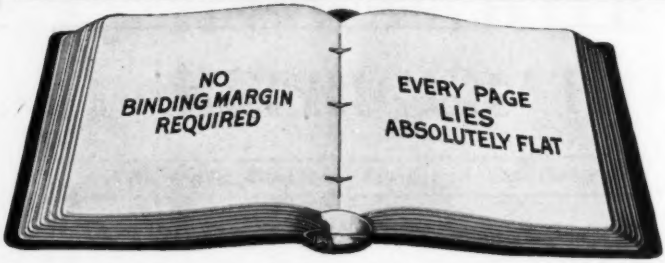

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A Monthly Illustrated Journal Devoted to the Interests of the Refrigeration Service Engineer in the Servicing of Domestic and Small Commercial Refrigeration Systems and Oil Burners

OFFICIAL ORGAN REFRIGERATION SERVICE ENGINEERS' SOCIETY

VOL. 2, NO. 2 CHICAGO, FEBRUARY, 1934 $2.00 per Annum

Diagnosing Motor Troubles

The Author Recommends That the Service Man Familiarize Himself With Simple Tests Which Can Be Made to Determine Motor Troubles in the Field. Caring for Refrigerator Motors to Prolong Their Life.

By GEORGE C. TATEM *

IT is rather interesting to note the progress which has been made during the past four or five years in the development of electric refrigeration, and we have noted time and again the advertisements which were directed to bring out such things as the efficiencies, insulation, porcelain, cold controls, etc. We have likewise often wondered at the little publicity given to one of the most essential parts of an electric refrigerator, namely that part which in reality gives life to this household necessity—*the electric motor.*

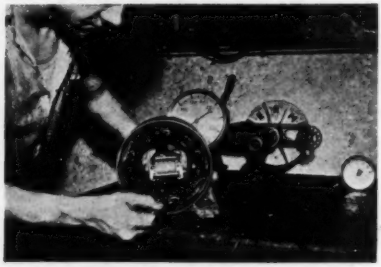
It is from this unit which so much is expected, yet receives so little attention, and which to the Distributor, Dealer, Ice Cream Company and independent Service Man, frequently governs whether or not their Service Departments will show a profit or deficit at the close of the year. This is based not only on repair costs but on the incidentals in connection with a motor failure which includes a Service Man's time, the use of an automobile, and its maintenance, *dissatisfied customers,* and in some cases the replacement of certain foods, or a suit for the recovery of spoiled merchandise.

It is usually true that the Service Man sadly neglects this important unit. It should be impressed upon him that oiling and cleaning the motor periodically will result in a substantial saving over a period of a year. If a motor was periodically inspected and properly fused, we venture to state that service maintenance cost could be decreased 20% to 30%, due to the fact that minor troubles could be detected and properly corrected at a nominal cost, while on the other hand, continued neglect results in the motor either partially or completely burning up.

There is a great deal more to the servicing and repairing of electric refrigeration motors than the trade realizes, due to the fact that it is necessary to use expensive equipment in testing each individual part as well as giving each motor a thorough test after repairs have been completed. Before a motor is permitted to leave a shop it must have undergone all conditions which could be expected of it while operating in the field, as usually a one year guarantee accompanies each motor after it is repaired.

* Sales Manager, Electric Refrigeration Motor Co., Inc., Philadelphia, Pa.

Fractional horsepower motor repair work is highly specialized which necessitates very careful handling insofar as the test equipment in testing the windings and commutators is concerned, as well as the careful attention which must be given to the winding



Inside Growler Test of Stator Showing in Background Special Hydraulic Motor Break Test

of both the armatures and stators. It is commonly known that a great deal of difficulty is encountered in the rewinding of an armature; a number of these units being shorted after being rewound. This is due to many causes, the majority of which can be laid to inexperience. It is of utmost importance that the laminations be laid in such manner that they will not cross, otherwise they will rub through and a short circuit will develop. In some cases they even chafe while being rewound. Likewise the baking process has a great deal to do with the finished product, taking into consideration the Fahrenheit temperature of the ovens and the length of time being subjected to heat. In a great number of cases it is necessary to pregnate units before giving the final baking.

Our company is probably one of the largest firms specializing in both refrigeration and oil burner motor repair work and as a consequence we have developed special testing apparatus for our shop. One of the high-lights of motor repair work is in having the proper equipment for giving a motor an actual load test after being repaired. This test includes testing the motor for torque, RPM's, amperes, wattage, heat and running load test.

We believe that a great many minor motor conditions could be corrected in the field if the average service man would educate himself along the lines of securing the steps which should be followed out in diagnosing motor troubles in the field. We are therefore listing below a test which it is possible for the average Service Man to make while on the job and without the use of any special equipment. This is a diagnosis of electric motor troubles on Repulsion Induction Types:

1. If the name plate is burnt or red in color, is a good indication that the motor is burnt up.
2. *Check Bearings* for up and down play, also side play. If you cannot feel any play in bearings this way then pull out wick, take a flashlight and light up oil well and move the shaft again. If there is any wear on bearings you will see the oil squeezing out by the side of the shaft.
3. Sparking at brushes may be caused by brushholder off neutral. Try shifting brushholder to top dead center where armature locks and will not rotate in either direction, then move brushholder (with current off) one and a half bar towards direction of rotation. Check brushes and see if they are parallel with commutator bars and not riding on two bars at the same time. Check brushes to see if they are free in brushholder. Check brush

Armature Winding Which Is Done Both by Hand and Special Needle Process

spring tension. Brushes may be worn down which will cause sparking.

4. Check brushholder for wobble when motor is starting on repulsion. There are several things that may also cause

a brushholder to wobble: (a) worn brushholder; (b) one or two brushes shorter than the rest; (c) governor weights push rods worn, or commutator face may not be true.

5. Check for thrown solder. Check windings to see if they are burnt, charred, etc., by inserting fingers through inspection plate hole.
6. *Shorted armature.* Turn off switch, lift brushholder and brushes off commutator, turn on switch. Remain holding brushholder and brushes off commutator with left hand, revolve armature by pulley with right hand. If armature will not turn and has a tendency to lock, it is shorted. Do not confuse a dragging armature on the pole pieces where bearings are worn out with a shorted armature. If armature is not shorted it will revolve freely.
7. *Shorted stator.* (a) Lights will dim. (b) Correct size fuse will blow. (c) Start motor with compressor load on if armature comes up to speed and throws out brushes, off commutator, then the speed decreases again causing the brushes to go back on commutator. This is a good indication of a shorted stator but can not be relied upon a hundred percent because the governor spring may be weak, or the short circuiting device may not be making good contact. If you run into a condition like this, would suggest removing the short circuiting device and governor spring and push rods. (a) Check push rods for wear; this will cause the trouble sometimes. (b) Clean short circuiting device or replace with new bracket. (c) Replace governor spring or stretch the old one a bit.

Stator Winding. Note in Foreground Coils Which Are Wound on Coil Winding Machine

Electrically Heated Bake Oven

8. *Excessive, uneven rumbling in motor.* If bearings are OK disconnect motor from base, remove belt, then start motor. If it vibrates and shimmies off base, then the cause is—armature out of balance or field coils with some turns left out of one or two coils, or too many windings in some of the coils.
9. If motor does not come up to speed on start, take your watch and time the motor or count the number of seconds it takes for the motor on repulsion, then mark the brushholder setting. Move the brushholder against rotation about ⅛". Check motor

again to see if you have caused it to gain speed. If not, move brushholder 1/8" from original brushholder setting in direction of rotation and check again. If no gain in speed is accomplished check temperature of motor for heating up. If it is found to be heating and you are sure the compressor is OK there is a possibility that either the armature or stator is shorted, or that the bearings are worn.

Special Armature Winding and Commutator Test, Using Neon Tube to Determine Amount of Moisture in Windings

10. Always test each lead for a circuit, individually.
11. Grounded stator. Unless a ground is bad it will not show up on 110 volt.
12. Grounded armature. To test remove from stator, take off brushholder and pull out short circuiting device.
13. If excessive brush wear is experienced, check the armature for an open circuit.

In summing up, a great deal of motor troubles could be eliminated, and we feel that Service Men should train themselves more along electrical lines, in addition to developing their knowledge of compressors, etc. You would be surprised at the number of men servicing refrigeration equipment that are not even capable of changing the connections on a motor from 110 to 220 volts.

* * *

SERVICE POLICY OF REFRIGERATOR CODE

THE Refrigeration Division of the National Electrical Manufacturers Association has included in its proposed code of fair practice the following provisions relating to its warranty and service policy:

Article V—Warranty and Service Policy

(a) Employers shall conform without deviation to the following form of warranty:

"The Corporation warrants to the original purchaser the refrigerating equipment sold by it and all parts thereof to be free from defects in material and workmanship under normal use and service. The Corporation's obligation under this warranty shall be limited to repairing or replacing any part of said refrigerating equipment which proves thus defective within one year from date of original installation, and which the Corporation's examination shall disclose to its satisfaction to be thus defective. This warranty is in lieu of all other warranties expressed or implied and of all other obligations or liabilities on the part of the Corporation, and it neither assumes, nor authorizes any other person to assume for it, any other obligation or liability in connection with the sale of said refrigerating equipment or any part thereof. This warranty will not apply to said refrigerating equipment or any part thereof which has been subject to any accident, alteration, abuse, or misuse.

"The Term 'original purchaser' as used in the foregoing warranty shall be deemed to mean that person, firm, association, or corporation for whom the refrigerating equipment referred to therein is originally installed; or the bona fide assignee of that person, firm, association, or corporation."

(b) Employers may develop individual plans for providing replacement units in case of complete failure after the expiration of the warranty, provided that amounts not less than the following schedule shall be

billed to the customer and that such schedule of charges shall not be included as part of the selling price of the original equipment, and shall not be billed nor charged for in advance of such replacement:

For replacement in the 2nd year.....$ 7.50
For replacement in the 3rd year..... 12.50
For replacement in the 4th year..... 17.50
For replacement in the 5th year..... 20.00

(c) Advertising and sales promotion shall contain no representation which would cause any person to assume that an extension of the uniform warranty is intended, nor shall any representation be made in advertising or sales promotion which will in any way tend to confuse such unit replacement plans with the warranty.

(d) In any case in which an employer's policy with respect to unit replacement is referred to in advertising or sales promotion, such advertising and sales promotion shall state clearly the amount which has been added to the complete unit price to cover the average cost of unit replacement.

Fin Coils

A Brief Resume of Fin Coil Developments. Comparative Efficiencies of Fin Coils vs. Conventional Type Pipe Coils.

By A. F. HOESEL *

THE use of finned pipe or tubing for the purpose of heat transfer, and especially for the purpose of increasing the effective heat transfer surface in a given space, is not a relatively new development.

An examination of finned tubing patents, both domestic and foreign, which are quite numerous, surprisingly indicates that many of our so-called new developments are buried in antiquity; probably another case of these pioneers being ahead of their times.

In 1882 the De La Vergne Machine Co. of New York was supplying split circular fins to be clamped to piping in order to increase the effective heat transfer surface of the piping, and also to facilitate defrosting. These fins were used quite extensively, especially in breweries and packing plants, and a patent was issued for their particular form of construction.

This De La Vergne fin was probably the grand-daddy of our present-day refrigerating fin coils; yet it is also possible that this particular form of fin was merely considered as an improvement upon some prior uses.

This definitely places the use of finned pipe for refrigeration, although in a somewhat crude form as compared with our present-day constructions, to over fifty years ago.

An examination of bibliography on refrigeration indicates that the German, English and French refrigerating engineers have used cross fin coils over twenty years ago, in comparatively large quantities, considering the relatively small activity in refrigeration then as compared to now. It is surprising that the extensive domestic use of fin coils is a comparatively recent development.

How and why did the refrigeration fin coil arrive at its present-day prominence? As we all know, the successful household refrigerating machine is comparatively recent. The manufacturers of this equipment, after having developed large manufacturing plants and sales forces, decided to invade the commercial field in the smaller sized installations, such as butcher shops, delicatessen stores, etc., which up till then had been sold by the manufacturers of ammonia equipment.

Most of the evaporators used by these manufacturers at that time were of the flooded type, having looped tubing branches extending from the float chamber. These branches in many cases had flat sheets of metal soldered to them in order to increase

* Peerless Ice Machine Co.

the effective heat transfer surface. In the majority of installations, these evaporators would accumulate a frost build up the same as the old bare pipe ammonia cooling coil job, and because of the relatively lower capacity of these compressors, as compared with the ammonia compressor generally used on an equivalent job, the result was trouble, which in many cases was erroneously diagnosed as under capacity of the compressor.

Some time later the domestic cross fin type coil, as we know it today, was developed. Immediately the capacity of the compressors, which some had considered to be toys, increased to such an extent that jobs were actually being successfully refrigerated with the new installations of less than half the horse power of plants using bare pipe coils. From this time on, SO_2 and methyl chloride installations have assumed a widespread and successful use.

It might be well to remark here that the domestic fin coil success was not alone due to the fin coil, but was tied up very intimately with the development of a successful thermostatic expansion valve, which fortunately was accomplished at practically the same time.

The thermostatically controlled expansion valve is not a new development, as many of us might suppose. A patent granted in 1898 covered the basic features incorporated in all of the present manufactured thermostatically controlled expansion valves.

Since we are all more or less familiar with the construction of fin coils, we shall omit any description of them; however, we are more or less interested in the relation that the fin bears to the refrigerant carrying tube. In other words, what increase in capacity does a finned tube give over that of a non-finned tube? Since there is no absolute standard as to fin size and spacing, the closest answer to the above is that every square foot of fin surface, each side of the fin being measured, is equal to from one-third to three-quarters of the equivalent square foot of the refrigerant carrying tube, the smaller sized fins having the greater capacity per square foot of surface, and vice versa.

Taking a standard fin coil with a three-inch square fin, we have a condition where, if every square foot of the tube is taken to be 100 per cent of maximum efficiency, then every square foot of fin surface is only comparatively about 33⅓ per cent as efficient as the tube surface. While this may seem to be an inefficient assemblage, we must not lose sight of the fact that, while the fin proper is only one-third as efficient square foot per square foot as the refrigerant carrying tube, the relative surface proportions of the tube and fins are in the relation of about one to eighteen, which at the given fin efficiency means that one foot of finned tube, in this particular case, is as good as six feet of non-finned tube.

This relative inefficiency of the fin, as compared to the refrigerant carrying tube, has certain compensating advantages, namely, it forces us to use a much greater surface area, which acts to facilitate defrosting during the compressor shut-down period.

The defrosting of the fin coil during the compressor shut-down period is one of its most salient features, which contributes to its high *overall* efficiency. The prevention of an accumulative frost build up, with its accompanying relative decrease in refrigerating effect, means that the refrigerating cycle is at 100 per cent of its possible efficiency, in regard to the particular low pressure side equipment, other things being equal.

Fin coils are generally fed with the refrigerant liquid at their top point, which allows the minimum amount of necessary refrigerant, minimizes slugging and insures a good oil return. In unit coolers, due to their higher rate of heat input relative to the surface area, which produces a high rate of ebullition, it is quite customary to feed the refrigerant into the bottom of the coil.

Whenever connecting two coils in multiple very close together and with separate thermal expansion valves, it is well to provide against the possibility of one coil outlet temperature affecting the thermal bulb of the other valve, thereby cutting off the refrigerant feed to the other coil. This can be done by forming a trap in each suction line ahead of the bulb position, or by dropping each line prior to making the "T" joint.

Expansion Valve

The primary function of a thermostatically controlled expansion valve is to maintain a definite increase in temperature at the suction line over that of the temperature at the inlet, thereby insuring the maximum capacity of the evaporator under all conditions of temperature, without having frost-backs. Another function of thermostatically controlled expansion valves, on multiple evaporator jobs, is their ability to maintain varying temperature differences according to their adjustment, thereby giving varying rates of refrigeration produced by the evaporators. In other words, assuming two refrigerated compartments, one of which has an evaporator of such proportions that, in order to maintain the desired temperatures, it becomes necessary to operate the compressor half time, and the other compartment has an evaporator of such proportions that, in order to maintain its desired temperature, it is necessary to operate the compressor three-quarters of the time, it is evident that the first compartment will be too low in temperature with a compressor operating three-quarters time. Here is where the adjustment feature of the thermostatically controlled expansion valve proves its worth. By adjusting the valve to maintain a greater temperature difference between the inlet and outlet of the evaporator in the first compartment, we decrease its refrigerating rate to the point where the evaporator then produces the same amount of refrigeration in three-quarter time as it normally would in half time. Really, the actual result is exactly the same as if we had made the evaporator smaller.

During the normal operation of the valve, it has varying temperatures, and since air expands and contracts approximately 1/500 of its volume for every increase and decrease of 1° Fahrenheit in temperature, respectively, it follows that unless all of the bellows chamber joints are absolutely sealed, there will be a constant breathing effect through any possible leaks. The air going into the bellows chamber deposits some of its moisture upon the cool surfaces, and this gradual accumulation of moisture finally reaches such proportions that the normally movable parts become stuck with ice.

The most difficult multiple installations are those in which exact temperature conditions must be maintained in various compartments. Due to the varying refrigeration demand during the different seasons of the year, it is obvious that no single adjustment will suffice for all conditions, and if definite temperatures are insisted upon, we must have recourse to automatic controls.

The present standard hook-up for such conditions is a room thermostat controlling a solenoid valve in either the liquid line to, or the suction line from the evaporator. This hook-up has one serious defect in that it is either on or off, and since the refrigerating demands of the various compartments do not keep in time step, the compressor operates practically continuously.

There is being developed a new type of temperature control operating upon the throttling principle, which will maintain a definite room temperature during the compressor operation, thereby insuring a minimum operating time.

REFRIGERANT FOLDER

A NEW interesting folder has been recently published by the Virginia Smelting Company of West Norfolk, Virginia, which in addition to general information on the process of manufacture of V-Meth-L as purified by this company, gives comprehensive data on the properties of methyl chloride, its specific heat and solubility in water, as well as a comparison of its properties with other refrigerants and a handy pressure-temperature chart on ammonia, dichlorodifluoromethane, methyl chloride and sulphur dioxide.

This folder contains information of value to refrigeration service engineers, and a copy may be secured by addressing the company at the above address.

P. F. Wood,
Iowa.

"There is only one thing wrong with THE REFRIGERATION SERVICE ENGINEER and that is, it does not come often enough."

How to Tone Up Your Business

In this Second Article the Author Stresses the Necessity for the Service Man to Maintain Records So He May Determine Costs. This Article Describes Simple but Effective Accounts and Records.

By T. J. FOWLER

"WHY do I keep books?" The proprietor of a one-man business faced this question when his bookkeeper quit without notice, leaving the accounts in a tangled condition. He determined to devise a method of accounting to the point where he could check up the work as expertly as he could other departments of his business.

He glanced into the largest of his three mysterious books. Here a page disclosed his dealings with a supply house; farther on, with a customer; again with another creditor. Evidently the bookkeeper had sorted dollars and cents upon these pages, just as you would sort fittings and connections and put them into their proper boxes. These pages were boxes for every important group of receipts or disbursements. This book was his ledger.

The other two books did not sort amounts, but merely lined them up one after another as the transactions came along during the day, too fast to be sorted. One book recorded transactions involving cash; the other described all the remaining miscellaneous items. An index column on each ledger page referred to the pages of these books on which the transactions appeared; and it was evident that these books carried the original entries, being feeders for the ledger pages. These volumes were his cash book and journal.

Puzzling over these facts, it seemed to the business man that his two books were merely records of the day's business, and that the third book—the ledger—sorted everything, cleared away small details and brought the business to a sharp focus which showed profit or loss.

The customer or the court might at any time inquire into his business and ask: "When? How? Why? With whom? How much?" His cash book and journal, the business man saw, would give the answer. They would supply the detailed evidence of his dealings, witness his claims and warn him of bills falling due. First, however, he would find it convenient to consult the proper ledger page as an index to these items. This book, where balances were struck, could answer the broad question of his business: The customer's, "How does our account stand?" the banker's, "How have your expenses run for the last three years?" And the outside credit man's, "Is my O. K. on your $900.00 order warranted by your monthly business averages?" These answers would have meant making up a special statement based upon a search through many record pages had not his ledger pages freed every transaction of detail and brought all the transactions into the needed totals.

This man saw that it would be of advantage to have his accounts so divided that he could see his sales, his purchases, his costs, his expenses and his profits separately. He saw that his bookkeeping plan might be better adapted to these ends, and calling in his accountant, he worked over a standard system of accounting to suit his own purposes. He now uses vouchers and a duplicate check system, a cash book, a sales journal, several small ledgers for special accounts, and a general ledger. These half dozen volumes are no mystery to him. One group of them are catch-alls, where he brings together all the buying and selling of the day. The other pile—his ledgers—are boxes, where into one box he tosses his account against a real estate man, into another his bills from the supply

* President, Chicago Chapter No. 1, R. S. E. S.

house. On opposite halves of the pages he records what value in cash, in bills, or in stock is put in and what is taken out. At the end of the month he adds his balance, getting the totals with little detail.

Some Puzzling Bookkeeping Problems Answered

I know now that any system of bookkeeping merely records and balances. By finding the reasons back of my books and fitting them to my business, any one can take advantage of new accounting ways. Your gas drums, your stock bins, your coils of tubing, are apt comparisons to your business system; and the proper bookkeeping system is just as simple and sensible. One important rule to remember is "Credit on the right side what goes out, debit at the left what comes in."

Accounting is simply a method which hard-headed business men have worked out for recording and balancing what comes in and what goes out in the transactions of their business. When our business ancestors found themselves thumbing through their trade diaries dozens of times a day in search of various dealings, they developed a further bookkeeping process to do away with this inconvenience. This plan was to sort items into a final book, which gave balances, noting in another volume that each purchase or sale was classified under certain headings.

A separate book was then found convenient for first noting of cash items only. These are the three elementary books of account: the journal, which records; the cash book, carrying the original entries of cash; and the ledger, in which accounts are sorted.

Accounts arrange payments and receipts so that you may have a record of what is due to and from you; a cash payment and a shipment of supplies are both credited, the one to cash and the other to stock accounts. They are also both debited, the money against the person who is to pay you. The debit for the merchandise or service will warn you from time to time that its money value is owing to you. This warning will not cease until you receive the money for this service, and by a credit turn it into a record.

All accounts are either warning you of money due and owing, or keeping a valuable record of your dealings. To do this, they must handle not only tangible money, but also merchandise, service and other representations of money. They assign to them a cash value and debit or credit these values exactly as if they were money. You debit a cash payment on account to cash and credit it to who paid you; you debit the value of goods received on account to stock and credit it to whomever you must pay it. Although the two debits represent different things, money or goods, they are entered on the books as a single standard, their value in money. The master book or controlling volume, the "general ledger," takes these balances and boils them down into totals.

All of these books are operations, therefore, and are merely steps in this recording and balancing process. Under these two groups, books of record and books of balance, everything in accounting falls.

Any transactions of the four classes which make up accounting: (1) cash purchases, (2) credit purchases, (3) cash sales, (4) credit sales, must have an original record and must finally filter into the general ledger.

Knowing Where You Stand Is Important

The ledger "account" is merely an arrangement of two sets of like figures, items which come in and items that go out, so that, knowing what you had at the start, you can, by simple calculation, see what transfers have been made, what is due or owed, and what is on hand. This business man's plan of deciding what belongs in the left-hand or debit column, what in the right or credit column, was "debit what comes in, credit what goes out." This means that the left-hand column must show exactly what part of your business has been assigned to that heading, and the right hand column what definite value that heading is no longer responsible for.

One ledger page may be headed "cash," another "merchandise or service" and a third "accounts receivable." When you sell on credit, you credit merchandise, which surrenders that amount of stock, and debit accounts receivable, which becomes responsible. When the buyer pays you, you debit cash, which becomes responsible and, by a credit,

free accounts receivable from its responsibility.

When you fill out a voucher with a cash payment, or write a check and fill in the stub, or enter a sale on its proper slip, or make a cash collection, you are making an original entry such as business men generations ago made in their diaries. At night you assemble, sort and foot sales slips, add cash vouchers, count your cash, carrying your totals to the various ledger columns. Miscellaneous items which do not make up the bulk of the day's business, such as rent and other like items, will go into different columns of the journal. Where there is an important class of such items, as invoices of goods bought by you, you may design a special record book for it, which will, in fact, be the debit and credit columns formerly appearing in the journal under that heading.

These totals which you secure from the sales slips, the cash vouchers, and the cash after closing time are sorted out and focused into larger totals under the proper headings on the various pages. The unit of every transaction passes on to larger headings, such as expenses, cash, merchandise, discount and interest; and finally to the last step or grand total—the balance sheet. From the sales slip record—4 lbs. of sulphur dioxide—you, for example, carry the amount $3.00 as a part of the day's total to the credit side of the merchandise ledger, and the debit side of the cash account. When the monthly balance is taken, this item is without individuality in the general entry, "Total Sales $700.00."

When a purchase or sale is made on credit, you must have something more definite than a sales slip record by which to follow up tne collection or payment of the bill, the taking of a discount or the payment of interest. This is easily done by giving each creditor customer a ledger page, so that you may at all times know separately his responsibility to you and yours to him. From your original entry, you will, therefore, post each credit sale or purchase to its proper page in your customer's ledger or purchase ledger. You can then assemble the total purchases or sales under the proper heading without identifying names. When a customer has his $3.00 purchase of gas charged, you note his responsibility, $3.00 on his page in the customer's ledger, enter that amount as a part of the total shown to be due on the "accounts receivable" page, and on the proper "merchandise" page, see that a $3.00 credit is entered showing that amount of stock surrendered.

Keeping Records

Some businesses use a filing card credit sale account and others use loose-leaf ledger pages. The routine is the same. Posting of the sales slip, the debit to the customer on his card or page, and the credit to him when he pays; with the proper entries to merchandise accounts receivable, and cash. The card or loose-leaf system is easily expanded or changed to suit your needs, and especially adaptable to small or irregular accounts.

It is common practice to handle the accounting of a business without other books than this ledger of charge accounts, the purchase ledger, the cash book, sales slips and invoices. Profits, expenses, balance sheet and the present worth of the business are not given by these accounts and consequently such a system is not complete. A general ledger is necessary to round out your business information. This final ledger assembles on one page your total merchandise received and sold; on another, your accounts payable; on a third, your accounts receivable; and on other pages, your cash totals, your various groups of expenses and whatever other items are desired. It gives a close check on your physical inventory and keeps you informed of your expenses, profits and standing. The principle is simple, *debit against, credit with* the record of all business transactions, and a balance struck under the headings that are important to you.

The general ledger assembles the financial secrets of a business. It is the backbone of the whole business and, like a purchase ledger, belongs only in the hands of a bookkeeper or the owner.

S S S

A. G. Dietl,
New Jersey.

"I have enjoyed your publication, THE REFRIGERATION SERVICE ENGINEER, very much, and will be ready to re-subscribe when my present subscription runs out."

Typical Application of Small Commercial Refrigerating Unit

This Article Comprehensively Describes a Modern Small Commercial Refrigerating Installation. The Layout on the Following Pages Illustrates Cycle of Operation and Installation of Various Automatic Controls.

By JOHN ELLISON

THIS article is descriptive of the installation of the latest type commercial refrigerating equipment. Commercial refrigerating machines have been greatly improved in the last few years. The old-style machine, with its many unsatisfactory appurtenances, is gone forever, and instead we have the small high-speed machine and the finned coils. All the auxiliary equipment has also been greatly improved, so that the refrigerating machine of today is very efficient and practically foolproof.

The Refrigerator

The refrigerator should be well insulated, preferably with no less than four inches of some good insulating material. A well-built refrigerator is always a good investment.

Correct air circulation has much to do with proper cooling of the refrigerator. The width of the warm-air ducts added should be a little more than the width of the cold-air duct. The top of the baffle board and the top of the coil should be about equal distance from the ceiling. About six inches of space should be allowed between the baffle and the coil, and eight inches or more should be allowed between the drip pan and the coil. The drip pan should be insulated, otherwise it is likely to freeze through and will sweat underneath.

Theory of Refrigeration

Refrigeration has been defined as a system of absorbing heat and thus producing cold. All methods of refrigeration are based on the well-known physical law, that when a liquid changes to gas it absorbs a certain amount of heat, and when relieved of this heat the gas may be changed into liquid.

Refrigerant

The liquid or gas circulated through a refrigerating system is called refrigerant, or cooling medium.

Evaporator

That part of a refrigerating system in which the refrigerant is expanded or vaporized is called an evaporator. Any type of coils or refrigerating sections are evaporators, also called cooling units.

Refrigeration Cycle

The liquid refrigerant in the condenser (B) is under high pressure and will flow through the liquid line to the thermostatic valve (E). This valve may also be called a pressure reducing valve. In passing through this valve the pressure of the refrigerant is reduced to the pressure maintained in the evaporator. This low-pressure liquid evaporates, or changes to gas, and during this process absorbs heat from the evaporator. This heat-laden gas is then drawn out of the evaporator by the compressor, compressed, and discharged into the condenser. In the condenser, the gas is cooled and condenses into a liquid under high pressure. This liquid drains to the bottom of the condenser and into the receiver. The cycle of operations can thus be repeated over and over again.

Principal Parts of a Refrigerating System

Compressor (A)

The compressor may be described as a heat pump. Its function is to remove the heat-laden gas from the evaporator, compress it, and deliver it to the condenser. In the small self-contained units, the compressor is usually of the reciprocating, double-cylinder, piston type. Most of the small compressors

NO. 36

TYPICAL INSTALLATION OF THE

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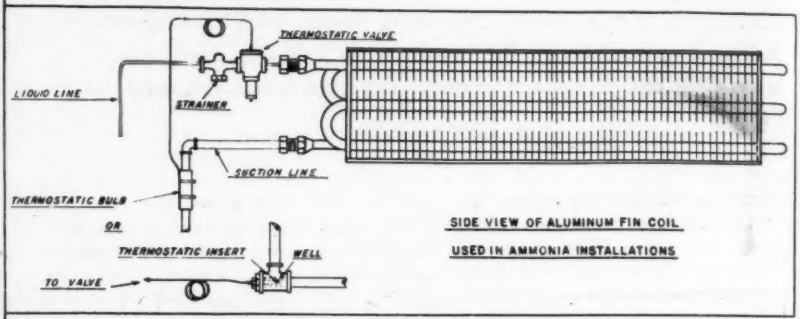
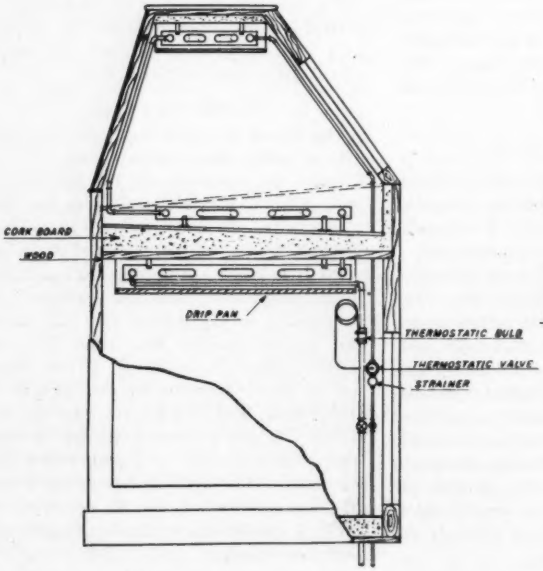
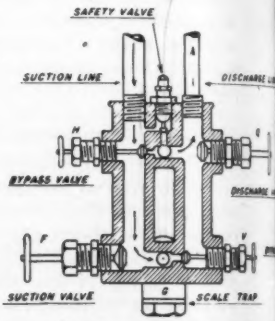


SIDE VIEW OF ALUMINUM FIN COIL
USED IN AMMONIA INSTALLATIONS

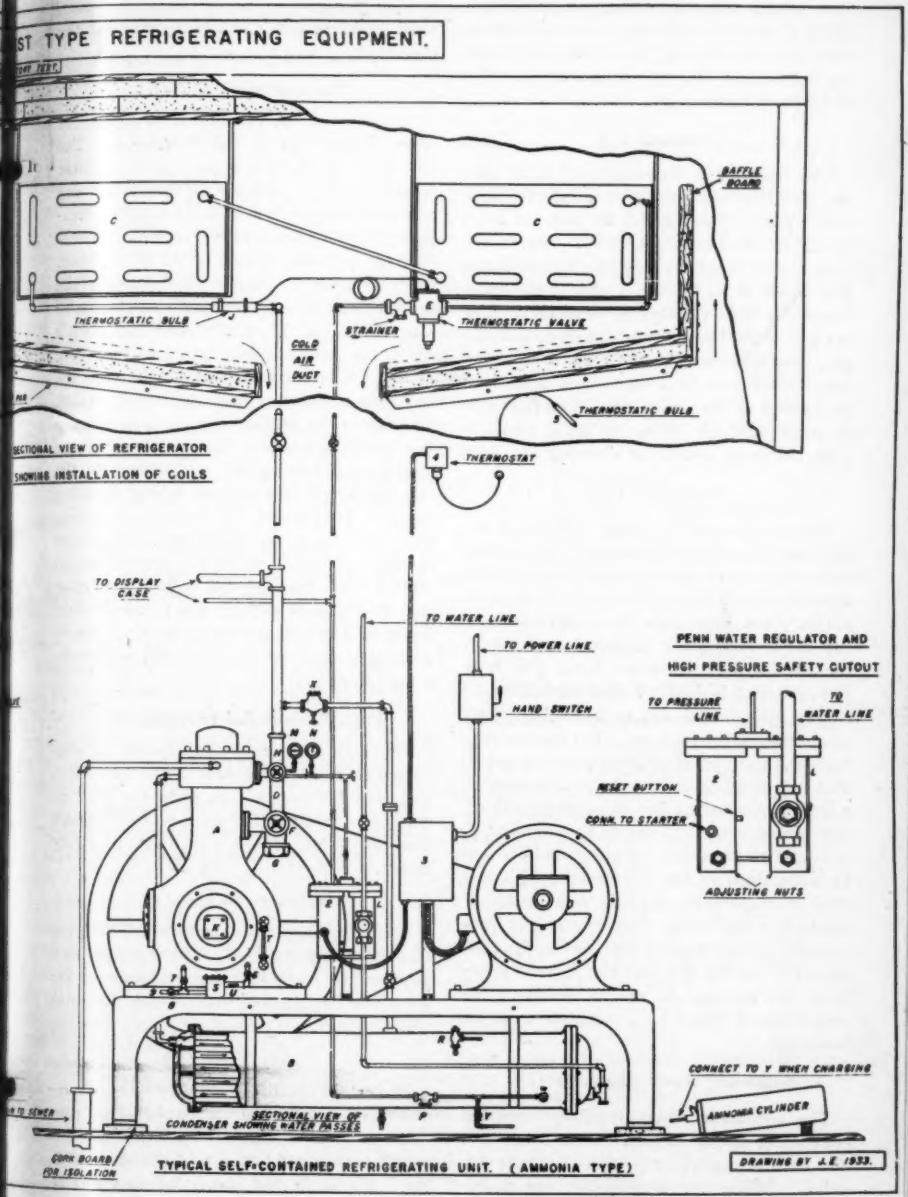


SECTIONAL VIEW OF DOUBLE
DUTY DISPLAY CASE



SECTIONAL VIEW OF TYPICAL
ONE PIECE BYPASS MANIFOLD (D)

END VIEW OF CONDENSER
WITH HEAD REMOVED


ST TYPE REFRIGERATING EQUIPMENT.
BAFFLE BOARD
THERMOSTATIC BULB
COLD AIR DUCT
STRAINER
THERMOSTATIC VALVE
THERMOSTATIC BULB
SECTIONAL VIEW OF REFRIGERATOR SHOWING INSTALLATION OF COILS
THERMOSTAT
TO DISPLAY CASE
TO WATER LINE
TO POWER LINE
HAND SWITCH
PENN WATER REGULATOR AND HIGH PRESSURE SAFETY CUTOUT
TO PRESSURE LINE
TO WATER LINE
RESET BUTTON
CONN. TO STARTER
ADJUSTING NUTS
CONNECT TO Y WHEN CHARGING
AMMONIA CYLINDER
SECTIONAL VIEW OF CONDENSER SHOWING WATER PASSES
CORK BOARD FOR ISOLATION
TYPICAL SELF-CONTAINED REFRIGERATING UNIT. (AMMONIA TYPE)
DRAWING BY J.E. 1933.

use the splash system of lubrication. A few have forced-feed lubrication. In this latter type, a small gear pump, which is driven from the crankshaft, forces the oil to all moving parts. The type of drive is usually multiple V-belts.

Condenser (B)

The function of the condenser is to cool the gas, thus allowing it to condense back into liquid. Drawing No. 36 shows a multipass shell and tube condenser. This is the type mostly used in ammonia installations. The water is in the tubes and circulates a number of times through the condenser. The hot gas is discharged into the shell, and the gas, coming in contact with the cold water tubes, condenses into liquid and settles in the bottom of the condenser. Thus this type of condenser also serves as liquid receiver. (See cut-away section in drawing No. 36.)

Evaporator (C)

The evaporator or cooling unit takes the place of ice in the refrigerator. The amount of refrigeration an evaporator will furnish depends largely upon the area of its exposed surface, and also upon the temperature of the refrigerant. The evaporator shown in the drawing is of the fin-coil type. This type of evaporator is made of steel, aluminum, or copper tubing, with fins of galvanized sheet iron, aluminum, or copper. The cooling surface of this type of evaporator is so great, that it is possible to cool the refrigerator to a temperature of 34 deg. F. or over, without any accumulation of frost on the evaporator. It is also claimed that a higher humidity can be maintained in the refrigerator with this type of evaporator, and thus dehydration of meats or other foods stored is largely prevented. In this type of evaporator, the feed should be at the top and the suction taken from the bottom. If this is reversed, the evaporator is likely to accumulate more or less frost.

Automatic Water Regulator (L)

The automatic water regulator supplies the correct amount of water to the condenser. The head or condenser pressure controls this valve. When the compressor stops, the pressure gets lower and the valve closes. When the compressor again starts, the valve gradually opens as the pressure increases, until sufficient water is flowing through the condenser.

Thermostatic Valve (E)

The thermostatic valve controls the flow of liquid refrigerant to the evaporator. The bulb (J), which is charged with a suitable volatile liquid, is clamped to the suction line from the evaporator. Changes in the temperature of the suction gas at this point affect the pressure of the liquid in the bulb. This pressure is transmitted through the flexible tube to a diaphragm which actuates a needle-valve. When the liquid in the bulb cools, the pressure gets less and the valve closes. When the liquid warms up, the pressure increases and the valve opens. Thus the valve will be more or less open as the pressure varies. This pressure of the liquid, in the bulb, will correspond to the temperature of the pipe or tubing to which the bulb is clamped. A strainer should always be used in the liquid inlet of all thermostatic valves, in order to prevent foreign matter from entering the valve. The valve may be adjusted so there will be no accumulation of frost on the evaporator. A heavy coating of frost reduces the efficiency of the evaporator.

High-Pressure Safety Switch (2)

The high-pressure safety switch is connected to the high-pressure line. This switch will stop the compressor when the head or condenser pressure for some reason becomes unusually high. In other words, it is a safety device.

Automatic Starter (3)

It is customary to use an automatic starter on motors over one H. P. The electrical load required to start the larger motors is too great for the control switch, hence the automatic starter.

Safety Valve (R)

In certain localities a safety valve is required on liquid receivers or shell-type condensers. The discharge from this valve is usually conducted to the outside of the building. About six feet above the roof will be an ideal place for this outlet.

Strainer (G)

This strainer prevents dirt and scale from getting into the compressor. Strainer (P) prevents foreign matter from entering the liquid line.

The Oil Pump (K)

The oil pump is usually of the rotary type. It is located in the blind bearing and is driven by a small shaft, fastened to the end of the crankshaft. The pump feeds from the oil carried in the crankcase of the compressor and forces this oil through the pipe (7) to the filter and sight-glass, and then through the pipe (6). Branch lines from this pipe distribute the oil to all moving parts.

Oil Filter (S)

In the filter, the oil is forced through a screen and then through a filter cloth, which removes all the dirt from the oil. The filter must be cleaned at regular intervals. In the sight-glass (U), the flow of the oil can be examined.

Oil Gauge Glass (T)

The oil gauge glass shows the oil level in the crankcase of the compressor.

Charging Valve (Y)

When charging refrigerant into the system, this valve should be open and the valve (W) should be closed. Thus the refrigerant will accumulate in the receiver, otherwise the operation of the system remains the same.

Bypass Manifold (D)

The bypass manifold shown in the drawing is of a type extensively used for ammonia compressors. When the suction valve (F) and discharge valve (Q) are closed and bypass valves (H) and (V) are open, the system is reversed; that is, the compressor draws the gas from the condenser and discharges it into the evaporator. The purpose of the safety valve is to relieve the compressor of any excessive pressure.

Thermostat (4)

The thermostat controls the temperature in the refrigerator. It is adjusted so that the machine will start when the temperature has risen to a certain point. When the machine is running, the temperature will be gradually lowered to a determined point, and the machine will stop. The thermostat shown in the drawing is of the remote type. The thermostat is placed outside the refrigerator, and the bulb (5) is placed inside the refrigerator. The bulb should not be placed in any of the air ducts, but should be placed where it will not be affected by the direct draft from the ducts. If the bulb is placed under the drip pan and toward the center of the refrigerator, a good average temperature can be maintained. The bulb and the bellows are charged with a gas which is very sensitive to temperature changes. A rise or fall of the temperature in the refrigerator affects the gas in the bulb, and thus the pressure of the gas will also rise or lower. This variation of the pressure, in the bulb, is transmitted through the flexible tube to the bellows, which actuates the mechanism that operates the switch.

Connections

Connections between the different parts of the system are made by heavy pipe and fittings. The screwed joints are made up with a paste of litharge and glycerine.

(X) is a high-pressure Check Valve. (M) is a Gauge for the suction pressure. (N) is a Gauge for the condenser pressure.

Ammonia Leaks

Ammonia leaks can be detected by burning sulphur near the suspected joint. A white smoke will be formed where the leak is. Leaks can also be detected by litmus paper. This paper, when moistened, will turn red in the presence of ammonia fumes.

S S S

Stillman Peck,
California.

"I look forward to your book with a lot of interest and hope, as time goes by, that I can secure more real 'dope' on service problems."

Charles Sonon,
Pennsylvania.

"I have found THE REFRIGERATION SERVICE ENGINEER to be of real help and think no service man should be without it."

E. Edwards,
Missouri.

"The magazine is the finest magazine that a service man could possibly have."

THE Question BOX

Readers are invited to send their problems pertaining to the servicing of household refrigerators and small commercial refrigerating equipment as well as oil burners to "The Question Box" which will be answered by competent authorities.

Question 31. What gases are used in the control bulbs of the various thermostatic valves?

ANSWER. Sulphur dioxide and methyl chloride are commonly used; the first for a sulphur dioxide and the second for methyl chloride systems. Generally the same refrigerant is used in the bulb as in the compressor.

Question 32. What is against leaving calcium chloride driers in the lines indefinitely?

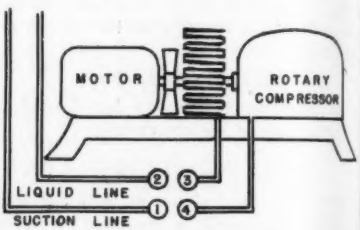
ANSWER. There are several reasons why a $CaCl_2$ drier should not be left in the lines indefinitely. First, as the calcium chloride becomes saturated, it loses its affinity for moisture and no longer serves any useful purpose. Second, as it becomes saturated it dissolves and you then have a calcium chloride solution, or brine, circulating through the system to cause trouble. Third, it breaks down into a fine powder which will pass through the screens and stop up the expansion or float valve orifice.

Question 33. I have difficulty with an Electrice unit made by Belding-Hall, and it has not operated satisfactorily since I have reassembled it and recharged the machine. It will refrigerate but not satisfactorily. I have tried charging the amount of SO_2 charge with little or no results. I have refitted the ball float and it apparently works O. K. The outfit consists of a Jewell porcelain double door box, with cast iron cooling unit having six trays on the first floor, and the motor is a General Electric, one-quarter horsepower.

The motor and compressor are located in the basement, with mercury switch and float on a shelf directly over the unit. There is no receiver.

Kindly let me know if the charge varies as to size of equipment and proper amount of charge. Is there a by-pass on the four valves, or in normal running are all valves open? My gauge set reads thirty-five pounds on the high pressure side and ten pounds on the low pressure side. What is the correct pressure? What is the vacuum on the low pressure? How can I test the rotary compressor?

ANSWER. The refrigerant charge for an Electrice unit of this capacity is 1½ pounds per tray. It is possible, from your description of the operation of this machine, that it may be either under or over-charged. You will find the valves in line with fitting for gauge should be enclosed when running, which corresponds to Nos. 3 and 4 shown on the above diagram. In testing for vacuum, refer to the above diagram. Close valve No. 1 and open No. 4. Close No. 3 and open No. 2. Under normal operation any vacuum reading between 17 and 28 inches will be found satisfactory. With no vacuum, of course, there will be no pressure. If possibly there is liquid in the oil, you will be unable to secure a vacuum. For this particular job, heavy Aragon oil is recommended. The removal of gears from the compressor is somewhat of a delicate job, and if these have been removed and reassembled it is probable that they have not been assembled properly, and therefore your compressor will not do any work.



TESTING DIAGRAM.

The Control of Refrigerants . . .

ARTICLE NO. 7
THE
THERMOSTATIC
EXPANSION VALVE

The Operation of the Thermostatic Expansion Valve. Description of its Construction Features and Application. Provides an Efficient Control at Comparatively Small Cost.

By J. L. SHRODE *

THE thermostatically operated expansion valve is used to regulate the flow of the refrigerant into an evaporating coil according to changes in the superheat in the refrigerant as it leaves the evaporator. This valve, a variable suction pressure valve, feeds just the amount of refrigerant required for the load carried and reacts almost instantly to load changes.

The thermostatic expansion valve is more efficient in its operation, more sensitive in its control of the refrigerant, and more flexible in its application than other types of control valves. This valve regulates the suction pressure in accordance with the refrigerating load and thereby materially increases the capacity of the compressor and evaporators. It prevents the return of liquor to the compressor and provides a means of obtaining a completely wetted surface in any type of evaporator including the so-called "dry type" series coils. It provides individual tempera-

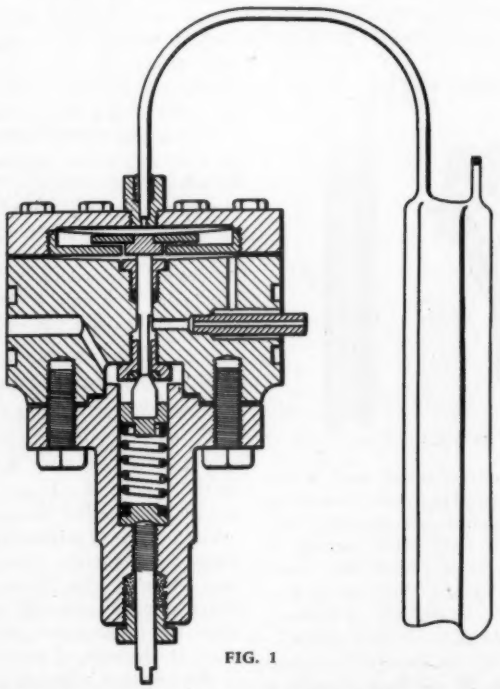


FIG. 1

* President, Alco Valve Co., St. Louis, Mo.

ture control of each unit in a multiple system with all evaporators connected in parallel to a single compressor. The thermostatic expansion valve combines efficient and high capacity operation with simple and inexpensive temperature control.

Construction

The thermostatic expansion valve consists essentially of four parts; the thermostat bulb, the flexible element for transmitting the bulb pressure, the adjusting or balancing spring, and the valve itself. A typical design of this valve is shown in cross section in Figure 1.

The bulb is charged with a volatile liquid and the space above the liquid, as well as the space in the tubing and the housing surrounding the flexible element, is filled with the vapor of this liquid. Generally this liquid

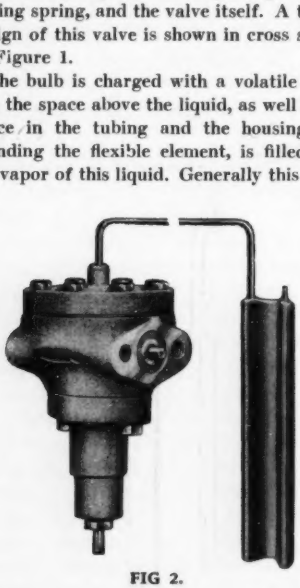


FIG 2.

is the same as the refrigerant used in the refrigerating system. The vapor pressure of the liquid in the bulb is proportional to the temperature of the bulb. This pressure is transmitted, by means of a small tube, to the top of the flexible element. This flexible element is generally a diaphragm or bellows. In the valve illustrated a stainless steel diaphragm is used. The diaphragm transmits the vapor pressure in the bulb through a buffer plate and push rod in such a direction as to open the valve.

Opposed to this pressure and motion is the suction pressure of the system exerted through the vent below the diaphragm. The resultant force tending to open the valve is then due to the difference between the vapor pressure of the charge in the bulb and the suction pressure of the system. At the bottom of the valve is an adjustable spring also pressing upward and opposing the bulb pressure.

The valve itself is very similar to the constant pressure type expansion valve described in a previous article. The liquid enters the valve at "A," passes through the pinvalve "B," and out through the discharge tube "C." The discharge tube prevents expansion at the valve seat, prolonging the life of the pin and seat. This construction prevents the valve body from getting too cold and in so doing prevents oil from congealing in the valve and improves the regulating qualities of the valve.

The bulb, tubing, diaphragm, and diaphragm housing is a single self-contained unit. It may be removed from the valve by unscrewing the cap screws which hold it to the valve. When this is done the diaphragm is not exposed, for the buffer plate which acts as a retainer is held against the diaphragm by a heavy lock ring. The thermostat charge is sealed in the bulb when the valve is manufactured and all joints are welded or soldered. The bulb itself is crescent shaped to fit around the outside of the suction line. An insert type bulb is frequently used on forced air systems and on fin coils.

S S S

OIL TRAPS

ANY compressor which pumps oil out with the discharge gas to the condenser may develop trouble, if the oil is heavy and of such quality that it will freeze or congeal at the evaporator temperature. If the amount of heavy oil in the evaporator continues to accumulate, it may freeze solid and stop the pipe. Oil in the evaporator produces a loss in capacity and, in time will allow the entire system to warm up to the point at which the oil melts and is blown out by the pressure behind it.

S S S

T. Wittberg,
California.

The REFRIGERATION SERVICE ENGINEER has been a real help to me. One suggestion I secured more than paid my subscription.

SERVICE POINTERS

Readers are invited to send descriptions of "kinks" which they have found to be of practical help in their every day work. Just send your idea or sketch in the rough, which will be prepared for publication. All contributors' names will be printed. Address the "Kinks" Editor, REFRIGERATION SERVICE ENGINEER, 433 N. Waller Ave., Chicago.

Compressor Knocking

FREQUENTLY there is a decided knocking in small compressors, and usually the trouble may be traced to improper clearance of the discharge valve. When such a condition exists, it will be found that the knocking is caused by the oil passing through the valve. Another noise that may be noticed in the compressor is that when the pipe from the condenser runs downward to compressor head, it will cause the oil to drop back, with the let-up of pressure when the machine shuts down. When the machine re-starts, this slug of oil is pumped over into the condenser coil causing a noise.

Removing Oil from Oil-Logged Coils

A METHOD that has been found satisfactory by service men in successfully removing oil from oil-logged coils is to loosen the boiler from its hangings and tip to the front. In doing this, the float ball will rise to the top of the boiler, thus causing the coil to flood and washing the surplus oil into the system. Service men who have employed this method claim that it is more satisfactory than the usual method of boiling out the oil.

Wiring

OCCASIONALLY it will be found that a service call is received that lights dim when refrigerator is operating. Usually it will be noted that it has been found convenient to hook up the refrigerator motor to the lighting circuit and this has overloaded the capacity of the wire, which has a high resistance, and the additional load will cause a voltage drop when refrigerator is operating. It is advisable, when practical, to run a separate circuit to the motor. Service men, of course, should be conversant with local codes regarding line loads.

Radio interference is another common complaint, and sometimes a cleaning and adjusting of brushes and commutator on the motor will correct the condition, and added precaution is to ground the motor to a cold water pipe.

Head Pressures

OFTENTIMES service men attribute high head pressures to air in the system. This condition is usually shown by the fluctuation of the indicator on the pressure gauge. After purging the air from the system by cracking the valve on the compressor head, the pressure will let down and the air collect at the top of the condenser, if the machine is allowed to remain idle for a short time.

Correct Amount of Oil

MANY troubles can be traced to improper amount of oil in refrigerating systems. Oftentimes, thoughtlessly, a service man will add more oil if he detects a compressor knock. If the system already has more oil than necessary, this will not rectify the condition. Don't guess. Know definitely the proper amount of oil necessary for the system.

Gas Velocities

THE allowable velocities for gas in the different parts of a refrigeration system for the commonly used refrigerant are as follows: Suction or piston valves, recommended, 2,500; maximum, 4,000 feet per minute. Discharge valves, recommended, 5,000; maximum, 8,000 feet per minute. Suction and discharge pipes, recommended, 4,000; maximum, 8,000 feet per minute. An allowable gas velocity of 8,000 feet per minute through a discharge pipe should not be used unless for short distances through valves and other short restrictions.

COMPLAINT CHART
NO. 9

How to Estimate Weight of Liquid Refrigerant to Half Fill a Receiver Drum or Flooded Evaporator

Let D = Diameter drum or cylinder in inches
L = Length of cylinder in inches
W = Ounces liquid refrigerant to half fill
R = Constant

Formula:

$W = D^2 \times L \times R$

R = 3/8 for sulphur dioxide or F-12
R = 1/4 for ethyl chloride or methyl chloride
R = 1/8 for Isobutane (Freezol)

Never fill receiver over one half.

To Estimate Ounces Refrigerant Sucked Every Minute from Charging Drum When Maintaining Constant Charging Pressure of 10 Lbs. Gage:

Rule: Multiply gross inside cubic feet of domestic refrigerator by (1/4 for methyl chloride) by (1/8 for SO_2) by (3/4 for F-12) by (1 for Isobutane).

Rule: (For commercial): Multiply lbs. I.M.E. per hour of compressor by Factor "C".

Oil:

1 Pint oil occupies 30 cubic inches and weighs one pound.

(9)

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433 N. WALLER AVE., CHICAGO, ILL.

REFRIGERATION SERVICE ENGINEERS' SOCIETY

Official Announcements of the activities of the National Society and Local Chapters appear in this department as well as articles pertaining to the educational work of the Society.

THE OBJECTS OF THE SOCIETY

To further the education and elevation of its members in the art and science of refrigeration engineering; with special reference to servicing and installation of domestic and small commercial equipment; for the reading and discussion of appropriate papers and lectures; the preparation and distribution among the membership of useful and practical information concerning the design, construction, operation and servicing of refrigerating machinery.

ASSOCIATION HEADQUARTERS: 433-435 North Waller Ave., CHICAGO, ILL.

Advantages of the R.S.E.S.

THE advancement of any industry is gauged by the progress of the individuals comprising that industry. The servicing of mechanical household refrigerators and small commercial equipment has shown rapid strides during the past five years. A large field has been opened to men who are qualified to maintain efficient operation of the equipment which has been and is being installed.

With the increased sale of mechanical refrigerators each year, and a greater use of commercial refrigerating equipment, not only for the preservation of foodstuffs but for new, important developments, such as air conditioning, the field assures a definite future.

THE REFRIGERATION SERVICE ENGINEERS' Society has answered the call of the profession for coordinated effort in the advancement of the profession. The Society, through its constitution, is definitely organized for the purpose of disseminating information concerning the design, construction, operation and servicing of small refrigerating equipment, and to extend its efforts in stabilizing the business of refrigeration servicing and encouraging ethical standards of practice. Irrespective of geographical location, the refrigeration servicing business has mutual problems that can be advantageously discussed for the benefit of the membership through the educational work of the Society.

Educational discussions at local chapter meetings and the preparation of material by the Educational and Examining Board of the Society, bring to its members advantages that are manifold. The Society invites the membership of any one identified in refrigeration servicing work. It also invites the consideration of groups of service men that may consider the establishment of a local chapter in their community.

St. Louis Chapter Organized

PURSUANT to an invitation extended to the service men of St. Louis and vicinity, seventy-six service men responded to a call for a meeting held on January 25, 1934. Mr. A. J. Robins of the Frigid Refrigerator Service Corp'n presided as temporary chairman, and the meeting was formally called to order at 8:15 p. m. in the Claridge Hotel.

As outlined in the call for the meeting, the purpose was to consider the organization of a St. Louis Chapter, as explained by the chairman, and Mr. H. T. McDermott, National Secretary of the Society, was then introduced.

After explaining the purposes and objects of the Society, and discussion by those pres-

ent, the following resolution was offered, seconded and carried:

WHEREAS, It is the consensus of opinion of those present that it is desirable to organize a cooperative society for the purpose of further education and elevation of men engaged in the business of installing and servicing domestic and small commercial equipment, and for social intercourse, now therefore be it

RESOLVED, That we immediately proceed to form and organize a local Chapter of the Refrigeration Service Engineers' Society by the adoption of a Constitution and By-Laws, in conformity with that of the National body, and that we further proceed to elect temporary officers and make formal application to the Refrigeration Service Engineers' Society for charter for a local Chapter.

E. J. ROBINS, PRESIDENT
St. Louis Chapter, R.S.E.S.

E. A. PLESSKOTT, SECRETARY
St. Louis Chapter, R.S.E.S.

L. VOLLMAN, TREASURER
St. Louis Chapter, R.S.E.S.

A tentative Constitution and By-Laws, which has been adopted for local chapters and is in accordance with the Constitution and By-Laws of the National Society, was then read, and it was definitely decided that regular meetings of St. Louis Chapter should be held every second and fourth Thursdays of the month, and that the Constitution and By-Laws would be referred to a committee to be appointed by the incoming president, and formally adopted, with any changes incorporated therein that should be deemed desirable, and which would be in accordance with the Constitution and By-Laws of the National Society.

The next order of business was the election of temporary officers, and inasmuch as it was necessary that at least a president, treasurer, and secretary be elected, the following were nominated for these offices:

President, A. J. Robins, Frigid Refrigerator Service Corp'n

Treasurer, Leonard Vollman, Pevely Ice Cream Co.

Secretary, E. A. Plesskott, Famous-Barr Co.

There being no further nominations, the nominees were unanimously elected. Election of other officers and appointment of committees will be taken care of at a subsequent meeting.

The petition for application for charter was then presented, and forty-eight members signed the application to be presented to the National Society.

The officers were elected as temporary officers to serve until the presentation of the charter.

Chicago Chapter No. 1

Meeting of January 19

AFTER disposing of the usual business of the meeting, President T. J. Fowler turned the meeting over to Mr. C. E. Hamilton, chairman of the Educational Committee, who introduced Mr. A. E. Hoesel, of the Peerless Ice Machine Co., who talked on "Fin Coils for Refrigeration Work and Automatic Control Valves." The discussion centered on fin tubing and the flow of air (forced or natural convection currents); also the relative heat transfer of various

metals used for the fin. Mr. Hoesel's talk before this meeting appears on another page of this issue.

Plans for the evening of February 23, were discussed, at which time Chicago Chapter will receive its charter from the National Society.

Meeting of January 23

The meeting was called to order by President T. F. Fowler, and the usual business of the meeting disposed of. President Fowler stated that plans were completed for the Banquet and Entertainment to be held on Friday evening, February 23, which will be the first annual banquet of Chicago Chapter, and that the Entertainment Committee has prepared extensive plans for this evening. Invitations were to be extended to every service man in Chicago and vicinity to attend this affair, which will be held in the Bal Tabarin of the Sherman Hotel, one of the foremost entertainment centers of Chicago.

The meeting was then turned over to Mr. C. E. Hamilton, of the Educational Committee, who introduced Mr. Harvey B. Lindsay, president of the Dry-Zero Corp. Mr. Lindsay talked on insulation in general, and gave interesting data on tests performed in their laboratories on several well-known makes of refrigerators. He then illustrated the flow of heat through various types of insulation and explained its reason.

At the close of Mr. Lindsay's talk, Mr. Hamilton answered several questions found in the Question Box. Further discussion by the membership centered on the future servicing of refrigeration machines, both multiple and single unit installations, and the cost of maintenance and operation per evaporator. Ethics of service was discussed among the members, and the meeting then adjourned.

New York Chapter
Meeting of January 19

THE meeting was called to order at 7:30 P. M. with President Herkimer presiding. Fifty-one members were present.

The object of the meeting was to arrange a system of cost and billing price for charging systems with refrigerant. The data was compiled by the Herkimer Institute of Refrigeration upon which the Committee of Standards were to base their suggestions and methods of arriving at cost. The following committee was appointed at the last meeting to investigate this subject:

COMMITTEE OF STANDARDS

Emil J. Merenda, *Chairman.*
Oscar Albrecht, *Secretary.*
August Fruchtenicht.
Arthur Dietrich.
John J. Mulcahey.
Bernard J. Beinert.
Benjamin I. Freer.
T. Albert Koehl.

To compile above data it must be recognized that the New York Municipal Code defines a Class "D" system as one containing more than six pounds and not more than twenty pounds of refrigerant and a Class "E" system as one containing six pounds or less of refrigerant. If the amount of charge in all the above systems for the various manufacturers are tabulated it will be discovered that the average amount of charge may be classified into the following groups.

Class "E" Systems, Domestic

Table 1
Low Pressure Float
4 to 6 lbs.

Table 2
Direct Expansion, High Pressure Float, Capillary Tube
1½ to 3 lbs.

Domestic systems require from 1/10 horse power to 1/3 horse power motors, and the above tabulation consists of the above charge including the evaporator charge.

Class "D" Systems, Commercial, Also Class "E" Commercial

Table 3

1/10	to	1 H. P.	3 lbs. average
1	to	3 H. P.	7 lbs. average
5	to	10 H. P.	15 lbs. average

In above table referring to commercial systems the amount charged is about ½ to ¾ full receiver as required by the I. C. C. Interstate Commerce Commission in filling gas drums. The above amounts in Table 3 do not include the amount in the flooded evaporator or coils which must be added to the above amounts to estimate the complete charge.

To compile a system of costs the time should be considered to and from the shop plus the time of charging. The service charge or the time spent in checking over the necessity for the charge is not to be included in

(Continued on page 30)

The REFRIGERATION SERVICE ENGINEER

A Monthly Illustrated Journal, Devoted to the Interests of the Engineer Servicing Refrigeration Units, Oil Burners and other Household Equipment.

Vol. 2 February, 1934 No. 2

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Official Organ
REFRIGERATION SERVICE ENGINEERS' SOCIETY

ANSWERING A SERVICE CALL

IN answering a service call, the service man should bear in mind that his first duty is to build customer confidence in himself, or the organization he represents. The customer naturally expects, when issuing a call for servicing, that a certain amount of time will be required for this work. After a careful inspection by the service man of the equipment, he should bear in mind that the work should be done with the least inconvenience to the customer.

The customer is not generally interested in a lot of talk on the mechanics of the refrigeration, operation and construction, but is primarily interested in having his equipment placed in first-class operating condition, as quickly as possible, consistent with good workmanship. If it is found that the repairs cannot be done on the premises, and it is necessary to remove the compressor or motor to the shop for overhauling, the customer should be informed exactly as to the time that this work will necessitate. Many service organizations are building customer satisfaction by having machines available to substitute during the time that repairs are being made, so that the customer suffers no inconvenience in refrigeration.

It is to be assumed that the customer is thoroughly sold on the efficiency of mechanical household refrigerators, and may consider it a reflection on his intelligence if told that the machine which he purchased is not efficient in its operation. In other words, the service man should carefully refrain from discrediting any machine, and devote his energies to placing the equipment in the best possible operating condition.

After all, it must be remembered that a refrigeration service man has one definite commodity to sell—service.

It is much better to spend some additional time in ascertaining, after the work is done, that the machine will operate satisfactorily, and in doing so probably avoid any of the expense or annoyance of a call-back, which is not only expensive but has a tendency to lessen the confidence of the purchaser in his service.

More service is sold through satisfied customers, probably, than through any other source, and this is undoubtedly the most satisfactory and inexpensive method of increasing business.

S S S

KNOWLEDGE IS POWER

"KNOWLEDGE is power," is an oft quoted phrase which has a deep significance. The individual or organization which fortifies themselves with a thorough understanding of the mechanics of their own business are preparing themselves for a more successful business life.

As an indication of the importance placed upon the cost of doing business, practically every industrial code filed under the National Recovery Act specifies that no commodity or service is to be sold below cost. Many industries have recommended the adoption of uniform methods of keeping costs, which include items that have undoubtedly been overlooked in computing these figures. This provision should have a healthy influence in the conduct of legitimate business.

Not infrequently do we hear of a wide divergence in the charges for refrigeration service work, covering practically the same type of work. In the final analysis, this can be only indicative of one thing—lack of knowledge of true costs.

If any business is to be successful, the first fundamental principle is to know the actual cost of the commodity which is to be sold, in order that a fair return may be secured for the service rendered. Apparently there has been a lack of knowledge as to what to include in costs, and generally it has been shown that divergences in establishing prices to secure a fair return may be traced to this fact. This knowledge is not difficult to obtain and is simply a matter of keeping intelligent records of every transaction which enters into each individual job.

THE REFRIGERATION SERVICE ENGINEER is of the opinion that when correct knowledge is ascertained of what constitutes costs, a more intelligent method of arriving at selling price is bound to be the result. In this issue is found an article, the second in a series of eight, that is intended to be a guide for those service men who may feel that, since they are operating a small establishment, it is not so essential to have a correct record of business transactions. However, based on past experience, it has been amply demonstrated that it is just as essential for these service men to be familiar with the methods of keeping records as it is for the larger industrial institution to maintain its accounting and cost departments.

MOVES TO LARGER QUARTERS

ON February 9th, Melchior Armstrong Dessau Co. will move into a new location at 800 Fourth Avenue, New York City. By taking these larger quarters in the heart of New York's refrigeration district, they are in a position to serve their customers and friends both here and abroad to much greater advantage.

Mr. J. J. Marshall, General Sales Manager, states that the stock of refrigeration accessories has been enlarged, and that the service to the American market has been augmented by stocks located in Boston as well as in Philadelphia.

The company, which now covers the entire Eastern seaboard, is a major factor in the

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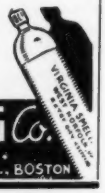

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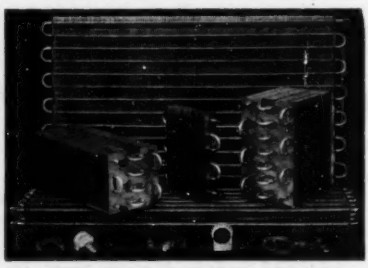

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R. S. E. S. NEWS

(Continued from page 27)

this table and should be billed under a separate item as a service cost and not as a charging cost.

In regard to estimating the cost of gas even though the service engineer purchases, for instance, Sulphur Dioxide in 150 pound lots at 15c per pound the cost to the service man for filling the small service drum should be based upon the prices of the gas manufacturer on the small quantity basis.

For instance, the manufacturers' selling prices on Sulphur Dioxide gas are as follows:

Sulphur Dioxide—10 pound lots.....30c
25 pound lots.....17c
Methyl Chloride—10 pound lots.....75c
70 pound lots.....48c
Isobutane—4½ pound lots.....$1.90 per lb.
Ethyl Chloride—2 pound lots....$1.25 per lb.
Freon (F-12)—10 pound lots....$1.75 per lb.
25 pound lots..... 1.50 per lb.

It was suggested by the committee that the service man should base his cost on the small lot basis whether or not he purchases the gas on a quantity basis.

A few of the various problems to be considered are listed as follows:

How much time should be allowed to and from shop?

It was a consensus of opinion that one-half hour should be allowed.

How much time should be allowed for charging?

It was a consensus of opinion that one-half hour should be allowed for charging.

What should be the cost allowance of the gas?

As above stated the cost allowance should be based upon the small quantity basis or the ten pound lot basis.

What should be the selling price of the gas?

It was a consensus of opinion 100% mark up was absolutely necessary in order that the service man show any kind of profit. In other words, it means doubling up the cost.

If gas is purchased at 30c per lb. it should be sold at 60c per lb. which does not include labor. The minimum refrigeration service charge was set up for the present at $1.50 per hour. Therefore, assuming a labor charge of $1.50 per hour and allowing one hour for charging the following problems were worked out on the blackboard.

How much should be charged for charging 3 lbs. of Sulphur Dioxide?

Selling Price of Labor for charging	$1.50
Selling Price of 3 lbs. of Sulphur Dioxide purchased at 30c per lb	1.80
Net Selling Price	3.30
Net Selling Price per lb	1.10

It was here suggested that any system operated by 1/10 to 1 H. P. motor containing 3 lbs. or less of refrigerant should be called a Class "X" system. Any system from 1 to 3 H. P. containing about 7 lbs. of refrigerant should be called a Class "Y" system. Any system from 5 to 10 H. P. containing about 15 lbs. of refrigerant should be called a Class "Z" system.

Resolutions were offered that two systems of prices be arranged on separate lists, one system of prices on the pound basis for the three classifications "X," "Y" and "Z," and another pricelist to be arranged on a horse power basis.

In the horse power table it is estimated that the Class "X" system contains the minimum of 3 lbs. of gas. In the Class "Y" system a minimum of 7 lbs. of gas and in the Class "Z" system, a minimum of 15 lbs. of gas. No bill should be submitted for less than these amounts on any system. The extra amount of gas required for the evaporators to be billed on the pound basis as listed in the first table.

TABLE 4—CLASS "X" SYSTEM
1/10 H. P. to 1 H. P.

Refrigerant	Selling Price minimum charge of 3 lbs.	Selling Price per every extra pound
Sulphur Dioxide	$ 3.30	$1.10
Methyl Chloride	6.00	2.00
Isobutane	12.90	4.30
Freon	12.00	4.00
Ethyl Chloride	9.00	3.00

TABLE 5—CLASS "Y" SYSTEM
1 to 3 H. P.
7 lbs. minimum charge

Sulphur Dioxide	5.70	.82
Methyl Chloride	12.00	1.70
Freon	26.00	3.70

TABLE 6—CLASS "Z" SYSTEM
5 H. P. to 10 H. P.
15 lbs. minimum charge.

Sulphur Dioxide	10.50	.70
Methyl Chloride	24.00	1.60
Freon	54.00	3.60

OSCAR ALBRECHT, *Secretary.*

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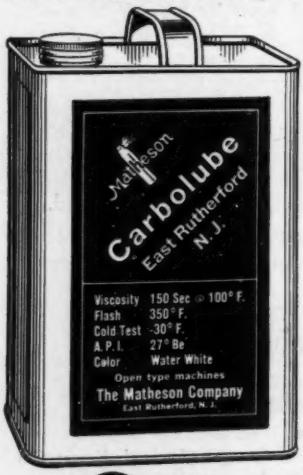

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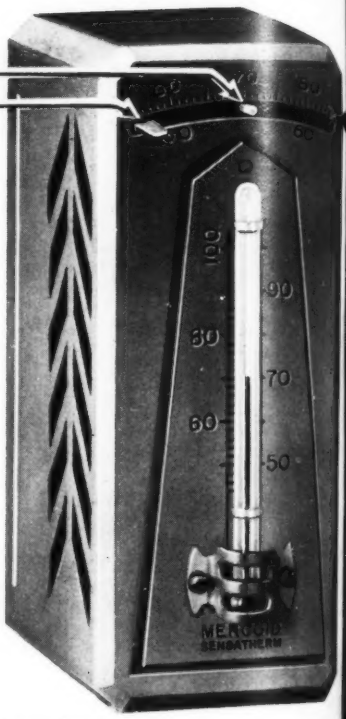

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